

## 6.20 Example T: Effective Thermal Conductivity Calculation

### Sample Input File For Effective Thermal Conductivity Calculation

The following example is used to explain the calculation of effective thermal conductivities.

#### Problem Summary:

Loading: Not Used (nplvl = -1 used to determine effective properties only)

Micromechanics Model: Double Periodicity

Fiber Packing Arrangement: Square Pack, R = 1., 50% fiber volume ratio

Repeating Unit Cell: 7x7 circular fiber cross-section approximation

Integration Algorithm: Not Used

Constituent Material Model: Fiber: Elastic, isotropic

Matrix: Bodner-Partom (viscoplastic properties not used)

Constituents: Fiber: Fictitious temperature dependent material (based loosely on tungsten)

Matrix: Fictitious temperature dependent material (based loosely on aluminum)

Test of user input properties with thermal conductivity

\*PRINT  
NPL=-1 %  
\*LOAD  
LCON=3 LOP=2 LSS=1 %  
\*MECH  
NPTW=3 TI=0.,200.,218. LO=0.,0.,0.015 %  
\*THERM  
NPTT=3 TI=0.,200.,218. TE=600.,21.,21. %  
\*MODEL  
MOD=1 %  
\*COND  
\*SOLVER  
NTF=1 NPTS=3 TIM=0.,200.,218 STP=0.2,0.01 %  
\*FIBER  
NFIBS=1  
NF=1 MF=6 NDPT=2 MAT=U IFM=1  
NTP=4  
TEM=18.,200.,400.,600.  
EA=314.1E9,300.E9,280.E9,200.E9  
ET=314.1E9,300.E9,280.E9,200.E9  
NUA=0.41,0.41,0.41,0.41  
NUT=0.41,0.41,0.41,0.41  
GA=111.38E9,106.38E9,99.29E9,70.92E9  
ALPA=4.5E-6,4.8E-6,5.1E-6,5.5E-6  
ALPT=4.5E-6,4.8E-6,5.1E-6,5.5E-6  
KA=0.2,0.25,0.31,0.44  
KT=0.2,0.25,0.31,0.44  
\*MATRIX  
NMATX=1  
NM=1 MM=1 NDPT=2 MAT=U IFM=1  
NTP=4  
TEM=18.,200.,400.,600.  
EA=72.E9,67.E9,55.E9,33.E9  
ET=72.E9,67.E9,55.E9,33.E9  
NUA=0.33,0.33,0.33,0.33  
NUT=0.33,0.33,0.33,0.33  
GA=27.07E9,25.19E9,20.68E9,12.41E9  
ALPA=22.E-6,24.E-6,28.E-6,33.E-6  
ALPT=22.E-6,24.E-6,28.E-6,33.E-6  
V1=1.E4, 1.E4, 1.E4, 1.E4  
V2=340.E6, 340.E6, 340.E6, 340.E6  
V3=435.E6, 435.E6, 435.E6, 435.E6  
V4=300.0, 300.0, 300.0, 300.0  
V5=10.0, 4.0, 1.6, 0.55  
V6=1.0, 1.0, 1.0, 1.0

```
KA=40.,38.,35.,29.  
KT=40.,38.,35.,29.  
*MRVE  
IDP=6 VF=0.5 R=1. %  
*CURVE  
NP=10 %  
*MACRO  
NT=1  
NC=1 X=2 Y=8 NAM=apdxt %  
*END
```

### **Thermal conductivity results from outfile:**

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#### Effective Thermal Conductivities

At Temperature = 18.0  
K Axial = 0.201E+02  
K Transverse = 0.889E+01

At Temperature = 200.0  
K Axial = 0.191E+02  
K Transverse = 0.852E+01

At Temperature = 400.0  
K Axial = 0.177E+02  
K Transverse = 0.795E+01

At Temperature = 600.0  
K Axial = 0.147E+02  
K Transverse = 0.683E+01

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